MANUAL TRAINING

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Manual Training

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The following discussion of Manual Training appeared originally in serial form in The American School Board Journal

Manual Training a Science

It is natural for us, when the country is stirred by some new movement, to look for the cause. To find the cause and recognize it is not always an easy matter. It is usually found in a combination of conditions that differ in their relations from those ordinarily existing, and therefore requires a point of view difficult to assume by those not thoroughly experienced in the new field of observation. That the introduction of tool work into the common schools has brought under observation a line of work requiring a point of view not easily gained by those accustomed to pass judgment upon our school work is easily believed because of the greatly varying opinions and suggestions which are given out as a result of those observations. It does not seem probable that in this new line of work there is no basis on which a definite theory can be placed. The present difficulty appears to be the all but universal difficulty of those long accustomed to a certain line of investigation failing to grasp the whole body of facts bearing upon the new situation.

So universal is the necessity for a new point of observation in the proper study of great advances in civilization that, however paradoxical it may seem, it is, nevertheless, apt to be

true that those having the most extensive training for the purpose of observing and judging of sociological conditions are unable to give to the community a full and correct statement of the value of any radically new movement in society. The work of the trained investigator appears to be to refine and diffuse after the radical changes have produced a sufficient body of material to make possible a new point of observation.

In no line of modern development is this more noticeable than in the movement for a department of school work capable of giving a larger value for those whose life's work is to be spent in some line of industry. If we will pause to consider what the new material is that is of necessity being brought into our schools as a result of this demand, we will have no reason to question this statement.

Turn to any discussion of industrial education by those considered best able to lead in educational investigation and we find the point of view substantially the same. Trained to a degree that should give them large confidence in their powers, rightly credited by all with a breadth of learning, strong in power to think out to infinitesimal distinctions along lines with which they are familiar, it is not surprising that they do not realize, nor should we censure them for not realizing, that they have lived and thought apart from a vast body of learning which is capable of supplying material

for not only an education for industry, but also material for liberal culture.

To those that have lived long in the realm of books, without dealing with any line of thought to be tested out by actual working of solid materials, there is another world about them unseen and unfelt, and neither considered in their observations and search for the cause of present unrest, nor in shaping their plans for the uplift of the industrial classes.

To make this *other world* real to those who hold in their hands the destiny of education is the burden of those who live in this other world, and whose lives have been such as to give them a view of the intellectual side of modern industry.

"We learn to do by doing," said by some one, and quoted by the millions, has so impressed itself upon this generation as to be taken as a fact, though, as ordinarily interpreted, it is little else than fiction.

For untold centuries the world progressed, if we can call that slow and tedious advance in mechanical work progression, by doing; and, had not the increasing necessities of the increased density of population and the comparing of methods as a result of the intermingling of nationalities caused a change from the learning to do by doing to the learning to do by *thinking,* we would yet be using the mechanical appliances of medieval civilization. From the doing and doing over and over to get the "knack"

or learn to imitate, the industrial advance has led to the thinking out of principles making the doing not the learning, but the test of the thinking which has preceded. This gives a foundation for growth; for there is no limit to the mind's activity. The handing down from generation to generation of tool processes or trade manipulations gradually ceases to be a factor and more and more each generation fits for work by the applying of principles, disregarding the details of imitation. This gives freedom and the era of invention is a necessary consequence. No child feels obliged to do just as his parent did. He has learned a principle on which the operation or process is based and feels free to make use of any muscular movement that does not do violence to the principle. The working out of these principles also eliminates many operations of the ancient craftsman because they are not in harmony with established law.

The development of the science of working solid materials not only gives freedom to use a large variety of processes or methods, but also is quite as useful in eliminating many methods of work which have come down to us by rule of thumb or blind imitation, and which are neither efficient nor intellectual.

This not only leads to progress in industry, but also to the building up of an intellectual side to industrial work. It is because of this change from imitative methods to those result-

ing from a study of the underlying principles of industrial work that modern industry has made so rapid an advance, has become so intensive, and has made the better classes of workmen intelligent members of society. It is this side of the work that gives to it its place in the schools, and it is the failing to recognize this that makes the present discussion of manual training lead into so many vagaries and the work of so many schools fail to produce the desired results in the industrial efficiency of their pupils.

Observing the physical side of the work, and not having gone deeply into the study of the science underlying industrial pursuits, those who are in a position to do much good fail to give material aid because from their position of observation they are unable to see that there is a science underlying the working of solid materials, a science which, though in its first stages of development, is yet sufficiently well defined to supply the material for our school shops, or that part of our school work leading to the industries.

When this fact is realized and we proceed to base our school shop work on science instead of tool processes, history, art, or what-not, there will be no call for specialization in the grades, and possibly not in the high school, nor will there be any need to separate those expecting to enter industrial lines from those fitting for the professions, because the study of the science

of working solid materials is quite as valuable a part of a liberal education as the study of any other science. Nor will there be any necessity for the introduction of matter foreign to the study of this science to give either interest or cultural value. All attempts to make of the school shop a study of things other than the science of working solid materials are abortive and an acknowledgment that the real subject matter has been overlooked.

Our present duty is to all pull together to gather the necessary material for the thorough establishing of this science, to eliminate the unscientific, the work that is based upon imitation, and the work that leads only to disconnected facts or details, to try thoroughly each statement of principle as to its truth, and then as to its use as a part of a broad foundation for industrial work.

By pursuing this course we can soon have such a valuable science as a basis for all industrial lines that the pupil, on leaving school, will be as reasonably assured of success in any industry as he now is in other lines. He will not only be free to enter any one of many occupations, but also will have a breadth of foundation that will serve him well in case at some time circumstances necessitate his changing from his chosen line to a widely differing one.

Viewed as a part of a liberal education, manual training is that branch of school work in which the mental activity of the pupil is tested by work upon solid materials.

The Subject Matter

— OF —

Manual Training

The Subject Matter of Manual Training

To know that manual training is a science is but the beginning of the work necessary to its establishing as a part of our school work. Those who are familiar with the history of the introduction and development of mathematics, physics and chemistry as parts of our school course have a basis for comparison in anticipating the nature of the task before those working for a rational course in manual training, or mechanical science. The latter term seems to indicate very clearly the nature of this division of educational work, and I think we may use it until a better name is found.

Apparatus and Principles.

The first and obvious conclusion after we learn that it is a science is that this material is in the realm of law or principle rather than in physical form. Although, like physics, mechanical science requires for its convenient study a quantity of apparatus, yet, like physics, this apparatus is not the science, but the means of demonstrating it. The bench, the lathe, the chisel, plane and saw are not implements to be manipulated for the purpose of the manipulation, but pieces of apparatus to be used in cer-

tain definite ways, so that a law or principle may be learned or demonstrated. The work of the shop is not to learn a series of physical movements, but to make use of certain carefully selected movements in order to learn fundamental principles that may be used in the determining of a variety of movements.

The inclined plane and balls in the physics laboratory are not for the purpose of giving skill in rolling balls, but to afford an opportunity to roll balls in such a way as to demonstrate the laws of falling bodies. One who has no knowledge of the physical sciences might roll balls all his days, even until he became more skilled in handling them than the student or teacher of physics; and yet never even so much as surmise that there are any laws of falling bodies. In like manner the imitative mechanic may use the tools of the trades all his life and never discover that there are any scientific principles in or back of these movements of tools. In fact, a careful scrutiny of men at work will reveal that herein lies a great deal of the difference between workmen, one working blindly to "get the knack," to practice until he "catches on," to "keep trying until he gets it," to "develop skill" and the other working thoughtfully, making use of such principles as he has been able to discover. It is the principles worked out by the individual workmen and gathered into a course that give a basis

for our manual training or mechanical science work, just as the gathering together of the laws worked out by various students of natural philosophy has given us the science of physics.

The Selection of Materials.

The gathering together of this more or less crude material is but the start in getting the subject matter for a school course in mechanical science. To yield a proper return for time and effort and the large expense usually incident to the teaching of shop work the material must be thoroughly sifted, classified and worked over to yield the largest possible value for the outlay. This process of elimination and refining has no limit so long as the race progresses, and therefore our subject matter can not become a fixed quantity. All we can do is to be certain that we have the best obtainable at the present time.

This naturally leads us to surmise that certain lines of mechanical work will yield better material than others, because some lines have received a larger amount of intellectual effort. I think observation bears out this suspicion, and that a thorough study of modern industries will convince us that some occupations are much farther advanced than others; that some are well established on scientific principles, while others are yet in the stage of craftsmanship. Therefore we must find our subject matter in those industries that are highly developed, or,

in other words, those industries that have a basis in scientific tool usage rather than in imitative processes or craftsmanship.

Eliminating the Unscientific.

But this is not all. In the present state of development no industry is entirely scientific, nor is any modern industry entirely lacking in scientific principles. It is therefore a most difficult task and a matter of the most serious importance, after we have determined what lines of work to make use of in our schools, to select from each line or trade that which is scientific and eliminate that which is not.

To introduce woodwork or any other of the highly developed occupations may mean the study of scientific principles of large application and great value; or it may mean simply the making of a few articles and the establishing of habits of work that will hinder rather than help, should the pupil attempt work in any industry.

Our subject matter cannot be selected by trades or groups, but must be determined by a rigid test to exclude that which is not scientific. Even after we have found that part which is scientific we have not done all possible, for even then there is opportunity for choice. Some of the principles may be of larger value than others, and if we will do that which is best we must make use of those things of largest value.

Universality of Principles.

In our study to determine those principles of largest value we discover that many of the principles are not confirmed in their application to any one trade or occupation, but that they are of such broad application that when learned in one material they are easily applied to other materials, even without any study in school of the other material. We find that although the tools and appliances used in the various industries differ widely, yet the principles governing their use are all but universal.

This relieves our school shops of all necessity of specialization or the use of detailed subject matter of special trades until these general principles have been learned. Such a division of the work is not only unnecessary, but is actually injurious to both the course and the pupil, for it tends to place in the course details not worth the time to learn and also to rob the pupil by crowding out the study of general principles which have a value as a part of a liberal education.

Therefore our subject matter for manual training is that part of the knowledge of working solid materials that is based upon scientific principles of the largest value, and the work of our school shops is the doing of such things as will best demonstrate and teach those principles.

The Attitude of Pupils

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Shop Work

The Attitude of Pupils

In any line of work, either in school or out, the attitude of the worker has much to do with the result. Although this may be of no more consequence in manual training than in other branches, so greatly do the pupils vary in their reasons for taking up this work and in their attitude towards it, that the matter of attitude becomes an element of chief importance. It not only has much to do with the methods of instruction, but also with the selection of material; the position of the branch in the course and its rank as a factor of a liberal education. The attitude of the pupil may determine whether the shop work is a part of a well organized course giving a liberal education or a "patch on an over-crowded curriculum."

What Should He Think About?

As a pupil takes up his plane or other tool, or a bit of material, what should he be thinking about? This may appear to be a trivial question. The answers to it vary greatly as given by different instructors. One pupil receives a bit of wood and at once a vision of a rule, plant stick, or other object appears. Another pupil receives a similar piece and at once the word "wood" is suggested. This is

followed by visions of lumber piles and perhaps trees. Such a train of thought may continue until the pupil is day-dreaming of some trip to the woods. It may recall the pleasures of tree-climbing until the piece of material in his hands, tools, bench and school shop are all forgotten and he is mentally in the top of some tree. Another pupil with his piece of wood in hand thinks neither of wood, lumber, trees or plant stick, but recalls some similar task and begins to plan how he may use what he learned in the former task in accomplishing this one. I venture to say that if we could read the minds of the pupils in some manual training classes, we would find some in trees, some using their plant sticks in flower gardens, and very few, if any, actually engaged in the thoughtful use of the tools required to make the desired piece.

Are these the correct places for their minds? Are these pupils, whose minds are away from the bench, gaining what they ought from the work? Perhaps some will hold the opinion that the manual training class is the place in which pupils are to proceed to the ends of the earth while their hands are absent-mindedly pushing a file or drawing a spoke shave. If this is the proper attitude, then what is the actual value of the tool work? Why are the pupils given tools at all?

Movements Should Be Definitely Directed.

The merest novice in physical culture would not expect to get results worth while by muscular movements not definitely directed. Can we expect in the work shop to get intellectual results from such movements? We certainly do not consider a movement of the hand or arm definitely directed, when the thought is only to get something done. To get something done may lead to the employment of another person to do it. The boy who wants a plant stick may get it by stealing, buying it or by hiring some one to make it, or by loafing about until he is given one. Any of these methods may get the plant stick. It is evident that if he is to make the stick, another element is essential and that element is the method of making; but to recognize that there is this other step is not all. A boy may want the object, recognize that work is necessary, and that it is all to a good purpose, and yet fail entirely to get the intellectual benefit from the muscular movements. He must go a step further and recognize the fact that there is a definite way in which to proceed, and that only by use of these definite methods can he get the best results in grade work and time. There is yet another step: He must recognize the fact that these definite things are essential and must be learned, not gained by imitation. They must be to him real intellectual activities, not mus-

cular movements copied from another. They must be things for his mind to do, not muscular reactions for his hands and arms only. When this step is taken the shop work ceases to be so largely a physical activity, the physical side being akin to the chalk, blackboard and muscular part of working a problem.

Every Movement a Victory.

The mind is no longer a "silent partner" in the work, but is actively planning and directing each movement; it ceases to look for operations to be imitated, reasoning out from what has been learned, methods applicable to the present task. The pupil ceases to ask how, rather asking why. This gives to every task a definite intellectual content, rendering the pupil capable of taking an invoice of each day's recitation, and instead of the dead subject of tool operations, requiring a taboret to get them done, the work becomes full of life. Every movement of a tool is a victory in the demonstrating of some principle in which the pupil has become deeply interested. He no longer thinks of the object, but of the thing he is learning, for he realizes that there is something to learn and that day by day he is making definite progress and gaining in ability to do really difficult work.

Desire for Power a Controlling Force.

Emerson tells us, "Life is a search after power." Although each of us might choose

to express this idea in a different form, yet we all recognize that the great moving force in all human activity is a desire for power, not the use of power to oppress, not the use of power to plunder, not the use of power to gather everything into one's own storehouses, but the realization of power within. The power will be used in different ways by different people, according to their moral control, or training, but the fundamental desire for a realization of power is the same in all.

We must not fail to distinguish between the condition of possessing power that is not realized, a false belief in the possession of power and the actual possession of power which is fully and definitely realized. Herein lies one of the chief values of shop work when properly taught, for in few, if in any other subjects, is it possible to give such exact tests for the purpose of causing a correct estimation and realization of the pupil's strength and growth from day to day.

Not only should the teacher strive to gain this attitude on the part of the pupil, but realizing the harm which may come from a false estimate of one's capabilities, no effort should be spared to so arrange the work that a true estimate will be gained. A false estimate may be established and pupils may be made to believe that they are learning and accomplishing that which is building them up in power

to do the world's work, but such a false estimate is sure to be discovered should the pupil attempt the practical application of his acquisitions.

A Change in Methods.

That such has been the case in some sections is evident from the reports of pupils failing to "make good" after leaving school. This has caused a change in the courses in some schools with a change in the attitude of the pupils. The impossibility of continuing to gain the attitude of study, because of former pupils failing to use successfully their school shop training, leads to various expedients to continue an interest which has lost its vitalizing force and the shop becomes a place to do or study a variety of things not capable of the exact tests, and knowledge for which the manual training schools were originally established.

Let Us Acknowledge Our Failure.

Is it not better to frankly acknowledge our failure to teach correctly the things we have attempted and begin sifting and improving the subject matter until we can teach fundamental principles of industrial work, striving for an attitude of study and desire for growth on the part of the pupils, rather than to bring in matters foreign to the manual training work and gain a false interest in the shops of the regular schools, making necessary the establishing of variously named schools to give

the advantages that, with properly taught shop classes, could easily be given in the regular schools?

To secure this attitude of study on the part of the pupil, should be a controlling factor in the organization and teaching of the shop work. It should determine the first lesson and make it of such a nature that the pupil will see in the shop work a means of gaining power and fix the mental attitude not upon acquisition of material things, but upon the increase of power which results from a definite realization that every stroke of the plane means not alone a truer surface, but increased power to true a surface; that every nail driven means not alone a bit of work completed, but an increase of power to do work. When finally the surface is trued, the attitude should be not that of a disagreeable task done for the purpose of a true surface or a plant stick, but a realization of power gained, and a wish for more surfaces to true.

The warrior who sat down and cried for more worlds to conquer, had simply taken a course on a large scale in the gaining of power. I am not in sympathy with the subject matter of his course, but I do admire his attitude towards his work. Give to the boy or girl the manual training work with hammer and saw, instead of sword and spear, so that they will gain the same attitude because of each day hav-

ing a definite realization of increasing power, and there will be no lack of properly qualified hands to do the world's work, either mechanical or professional. Degrade the work by making it a task for a prize, whether it be a card, a medal or a taboret, and your pupils will go out into the activities of life, not looking for opportunities to use their strength, but inquiring by what means they can easiest get a taboret.

Manual Training

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Industry

Manual Training and Industry

We come now to a very important part of the manual training problem, for, although manual training is believed by many to be equal in rank, as a factor of a liberal education, to any of the old line subjects, yet in the final tests it will undoubtedly stand because of its large industrial worth, or fall because it does not demonstrate its special value for those who engage in some branch of manufacturing. It is well, therefore, to consider carefully each detail of the work that we may give to the school shop the largest possible industrial value consistent with this branch being a part of a course yielding a liberal education. We may discover that when the work is properly taught there will be no conflict between the industrial and educational values.

In developing a branch that differs in so many ways from those considered as fixed subjects of our school course, it is not easy to determine what its scope shall be to yield the results desired. In fact there is not yet a unanimous agreement as to what ought to result from the teaching of shop work in the public schools. At the present time we may profitably consider both that which is needed to fit the pupils to do the work of a tradesman

as at present carried on and also that which will best lead towards ideal efficiency and the highest type of manhood and citizenship.

Two Factors Necessary.

Two factors are necessary for the highest type of workman aside from the broader qualification of general intelligence. The first is competency to do the work. The second factor, often of quite as much importance as the first, is adaptability, the power by which the workman is able to change employment with a minimum of loss, both to himself and to his employer. This change may be for the purpose of developing a new line of work without change of employer, or it may be a change from one establishment to another. The first factor may result from long experience with small intellectual activity. The latter can come only through a thorough knowledge of the principles common to a variety of occupations.

Industrial education cannot wait for the development of some theory, but must show some results worth while as the theories are being worked out. Neither can we expect the public to tolerate experimenting, based only on the theories developed apart from the actual activities of occupational life. We should, however, aim not simply at the production of a class of workmen on the level of present industrial life, but ought rather to strive for the advancement of the work to the best system of production,

and the advancement of the worker to the largest efficiency and the highest type of workman.

Great Diversity of Industries.

We may gain information to guide us in planning our new line of school work by a study of industrial life. Such an investigation leads at once to the observation that our industries comprise an extremely wide range of activities. It is therefore necessary to decide whether a pupil should be fitted for only one industry or given a training that will make possible the successful entering of any of a large class of industries.

Should we attempt to fit for a single industry, we meet the very serious difficulty of various practices in the identical same line of work. Many illustrations can be given to prove this point. The following statement in a technical periodical* is sufficient: "It is always interesting to note the various ways in which the same class of material is handled in different shops. Of course, this difference is sometimes a case of necessity rather than choice, as a shop is often originally planned and equipped for an entirely different class of work than that for which it is finally used, but even where shops have been fitted up expressly for certain similar lines of work, the divergence in methods or tools is often very marked." This variety in methods in the same industry as well as the very great diversity of industries,

*Machinery, New York, August, 1909, page 921.

is a factor to be reckoned with in every community attempting any sort of specialization in the schools. So evident is this multiplicity of trades and occupations that it seems to us that those who believe the schools can fit for individual trades have the burden of proof on their hands, and until there is reasonable proof that the communities can be generally accommodated by such schools, we may reasonably assume that the public schools cannot develop a line of trade schools sufficiently comprehensive and sufficiently diversified to accommodate the public as a whole.

Even if by application of the rule of the greatest good to the greatest number, we succeed in establishing trade schools in various communities, each accommodating the leading occupations of its community or city, are we doing the best for the community as a whole? Can any division of our population receive the best that is their due if the boys and girls are born to an occupation as must necessarily follow such a community specialization?

Two Types of Workmen.

A further evidence of this variety in shop detail and the inefficiency of simple trade instruction is shown by the different degrees of success met with by men as they move from one shop to another. Some change from place to place, each time advancing in their work; others, on leaving the shop where they first learned their

work or trade, find themselves unable to meet the conditions of the new place. They are obliged to begin again, making little use of their first training. A thorough study of these types of workmen reveals that one has been ever a student of principles, the other has worked just as hard learning tool manipulations and may be fairly capable of studying the work in the other manner, if properly directed. Shall the school courses be organized on the plan of actual shop life, permitting each pupil to progress under instruction similar to that of actual apprenticeship training, teaching tool manipulations and processes with only the exceptional pupil gaining a knowledge of principles? Or, is the work to be made a real school subject and handled according to well established pedagogical laws so that every pupil will be led into the broader field of trade work?

In determining the name and character of our schools, we must not overlook the fact that a school may be called a trade school and yet do much more than teach a trade or a certain number of trades, and also that a school may be named the very opposite of a trade school and yet teach only trade manipulations of very limited value.

School Shops Should Not Drill for Skill.

To treat the shop work of the school as craftsmanship, drilling for skill in some special line, or in certain selected tool manipulations,

whether from one trade or from several trades, is to turn out a class of pupils of more or less efficiency with but a small percentage capable of adapting themselves to a sufficiently wide range of occupations to insure anything above ordinary success, and this is now gained by a large number of boys without the advantages of a mechanical school. Unless the school shops can show returns exceeding, to a considerable extent, the ordinary conditions of training, there will be great difficulty in sustaining them at public expense. That pupils may receive some advantages because of opportunities to learn drawing, mathematics, etc., and because of this, show themselves superior to the ordinary shop apprentice, is no excuse for not giving the best possible shop training.

In our enthusiasm, we ought not to overlook the fact that there are several things that may increase the standing of the young mechanic. If a boy who has completed a certain course goes into a factory and is advanced over boys who have had substantially no schooling, it does not prove that every branch of the course has been what it ought to have been, or even helpful. In so large a number of subjects, the sum total may be helpful while some of the factors are decidedly harmful. It is not a question of making one boy better than another, but rather of making each boy the best possible for the time and expense at command.

Strive for the Larger Things.

It therefore appears that if the school shop is to give results to warrant its cost, it must turn to the larger successes of trade life, a large percentage of those who pursue its courses. This does not mean that they are to train for foremen, superintendents, or other executive positions, but that they are to give to a large percentage of their pupils such a training as will lead them to a thorough knowledge of the principles underlying the every day details of their work, and because of this, to use a high degree of intelligence in their common occupations. This does not mean that the special aim of the manual training school is to make of the boy an intelligent citizen. This is already accomplished by the old line subjects. The special feature to be added by this new line of school work is the making of his daily labors such as will require and continually build up his intellectual activities. This necessitates not simply the teaching of the boy to do a certain line of work, but rather the teaching him to do his work in such a manner as will cause a large use of his mind and consequent growth of intelligence.

Shop work in school is not so much for the purpose of teaching tool work as for the purpose of improving the intellectual and manhood factors in the work. In one sense, its purpose is similar to that of teaching literature. That

is taught not for the purpose of teaching reading, but for the purpose of getting out of reading that which will build up the larger and higher intellectual activities. Shop work should be taught not simply to make the pupils work, but for the purpose of getting out of work the highest and noblest that is possible.

Make the Workmen Intellectual.

We must not forget that a higher grade of intelligence can be maintained only by making the work of a more intellectual nature. To attempt to lift the workman by patching on to his education a little superficial knowledge of various outside lines of "culture," or by teaching him a lot of details in his own trade, which he is not likely to use, while leaving him to do his daily tasks by blind imitation and the muscular reactions which result from skill alone, is to fail in our efforts to elevate the tone of industrial life; for, unless we train the workman so that his mind is built up by the work on which he is daily engaged, his power to benefit by the extraneous training is sooner or later lost because of the impossibility of a mind more or less dormant through the active working hours continuing to respond to outside influences.

Industrial education should aim to make the task of the industrial worker as highly intellectual as possible, replacing in a continually greater degree, "rule of thumb" and imitative

methods by the highly developed scientific methods of modern mechanical science. It should mean not simply more boys entering industrial lines, but also a larger intelligence in industrial work. It should mean a constantly increasing number of workmen that put independent intellectual activity behind the routine and muscle of their daily tasks.

Makes Labor Honorable.

If the work of the tradesman is given the intellectual basis which it ought to have, there will be no lack of those to enter these lines, for such a foundation for the work must necessarily give it a standing and respect before all that will tend to make honorable the entering upon the life of a scientific worker in materials. To say that all work is honorable and try to create a respect for labor by having pupils perform certain tasks having some of the characteristics of daily toil is only to burlesque the whole matter. Take away from the commonly called lowly occupations of mankind, the long hours, the continued routine, the special conditions under which the laborer exists and the necessity for labor and they cease to be lowly occupations. None of these conditions of the laborer are possible in any sort of a free public educational institution. On the other hand, make the laborer a student of the laws governing his work, cause the whole community to realize that there is a foundation in law capable of being treated

as a science for all the laborer does and that he actually knows this science and is governed by it in his daily work, and he becomes a respected member of society because the intellectual obscures the physical. Allow the intellectual to subside and the physical to predominate and that man enters again the ranks of the "toilers." Respect is of the mind and its appreciation is for that which shows mental power.

Not a "Fad."

This we believe is the ideal aim of shop work at public expense. If so, it is neither a fad nor a patch upon the public curriculum, but the legitimate result of that advance in mechanical work which has changed the working of solid materials from cut and try and imitative methods to those based upon scientific principles. It is not the forcing into the schools of matter outside the legitimate lines of public school work, but rather the reaching out of the schools for a new and advanced line of intellectual activity to give to the curriculum a yet stronger and more efficient means of supplying to all a liberal education.

And why may not this be the aim of this new branch of school work? No shadow of evidence exists showing that by striving for the larger values we will lose any of the lesser advantages. No more equipment is required, no

longer hours are needed, no less interest in the work and no less usefulness on leaving school.

The boy or girl that has learned to put intelligence into the common tasks of life can do them quite as quickly and as well—we do not need to argue that we can do them better—while over and above all they can live a better life as a common workman, and, should opportunity offer, they are ready to do something larger for the benefit of themselves and the community that fitted them broadly for a life's work.

Methods of Instruction

— IN —

Manual Training

Methods of Instruction

Following our inquiry in regard to the nature of manual training, the subject matter of instruction, the attitude of the pupil in the classroom, and the relation of manual training work to the industrial world, naturally arises the question of actual classroom methods in such a system of manual training. It is not necessary that at this time we enter into a consideration of the details of classroom practice, but rather touch upon some of the more important features that distinguish scientific manual training or mechanical science from that of trade instruction or craftsmanship.

To those who look upon the shop work as necessarily a sort of recreation period, the teaching of a science with the pupils hard at work studying a text book and working to demonstrate principles, seems an impossibility, yet this is what actually takes place where scientific manual training is properly taught. Methods that will give this result are not so difficult as some suppose, as has been demonstrated.

That the attitude of the teachers and their knowledge of the work has much to do with the methods of instruction is too well understood by all school people to require any argument. We will assume that the instructor is fully pre-

pared and thoroughly in earnest. That such instructors cannot be found at present for all schools need not be considered in this connection.

Lessons Should Be Definite.

The first thing that the pupil is to take away with him is a definite feeling that he has learned something. Therefore the first lesson should be planned with a definite idea in it that is within the reach of the pupil. The instructor must ever keep in mind that the thing he is teaching is not history, botany, physics or even mechanical engineering, but the science of working solid materials, and must therefore use such methods as will draw upon this science for the ideas to be taught. This does not hinder such a consideration and correlation of other branches as may be gathered around the mechanical science with it as a center and basis for the whole.

The giving of this definite idea in the first lesson necessarily compels a very careful planning of the lesson, not only to be sure that the idea is in the lesson, but also that the pupil will actually get the idea instead of doing the work by blind imitation of certain muscular movements. This difficulty is akin to that of getting the pupil to understand a rule in mathematics, a proposition in geometry or a law in physics rather than merely committing the words by rote. The instruction of the shop, however, has a great advantage over that of any other branch,

because it is possible here to make the demonstration so vivid that an attempt to do the work by blind imitation is sure not only to be discovered by the instructor, but also to be realized by the pupil to such an extent as will compel a study and understanding of the idea behind the movement of hand or tool. Therefore one of the most important things is to start out in a manner to gain this study of the principles to avoid the doing of the work by imitation.

Limit of Accuracy.

Questioning should be the plan of instruction rather than *telling*. Working for a knowledge of the principles rather than grade of work should be the aim. The degree of accuracy to be required will then be determined by whether the point being taught is well understood. To reach a close measurement or to keep the corners and edges sharp is not a matter of skill but of knowledge of principles. To have a certain fraction of an inch as a standard to work to is certain to defeat the purpose of the work, for this leads the pupil to employ any method that will bring the material within the allowed variations. To have no standard other than the demonstrating of the principle must necessarily result in a large percentage of the work being brought to a much higher degree of perfection than it would be safe to place as an arbitrary limit, at the same time leaving an opportunity for the passing of particular pieces

that for special reasons are not as accurate as usually required. It is the same in principle as expecting absolute accuracy in arithmetic with the occasional accepting of a problem in which all the chief operations and principles are correct but the answer out because of a slight error in a minor operation. That this method in shop work does actually result in a high degree of accuracy is evidenced by the fact that teachers using the set standard of a certain fraction of an inch are unable to understand how the pupils in scientific manual training work to such close limits.

Again, this standard of excellence is not to be determined and attained by a continued criticising and compelling of the pupil to go over and over his work correcting little errors pointed out by the instructor, but rather it must be attained by a definite working to a satisfactory standard by the application of the principles taught. It must be the direct and legitimate result of the application of the principles without the aid of the instructor in pointing out small variations.

A shop method that permits a pupil to hesitatingly work first to an approximate size and then rework and rework, gradually approaching the line, is as pernicious in the shop as the writing of an answer to a problem in arithmetic and then guessing and trying to fill in the various operations.

The principle should be understood as a re-

sult of a step by step progress from the known to the unknown, and the result in the shop should be as certain and direct as the solving of a problem in mathematics. There must also be this advantage in the shop work, i. e., each problem must be so graded and adapted to the pupil that a reasonable effort will result in a correct solution. This of course excludes from the shop all wild, half thought out schemes of the pupils. In fact, proper methods of shop work will result in the pupil asking advice of the instructor for the purpose of selecting a project that will be of large value in what it will teach rather than in filling some material want. Probably in no other feature of the shop work is it so difficult for the layman to distinguish between that which tends to scientific manual training and that which does not as in the larger problems or projects.

The "Cant's."

The boy who "can't" or knows he "can't" should be taken in hand and made to see so clearly that he can if he will study his text, that he will realize his failure is his own fault because of not studying. If the teacher has a proper knowledge of the work and methods of teaching, the "can't's" will rapidly vanish, for as the scientific treatment of the work reduces the matter of skill to almost a negligible quantity, success becomes almost solely a matter of study and mental activity, and therefore every pupil

having normal mental power is with reasonable application able to succeed. This is not saying that all pupils will attain the same grade of work, but rather that all will attain a successful minimum. Further, this minimum need never be below a thoroughly well finished problem, and cannot be if the instructor use such methods as compel the learning of the principles and their definite application to each problem.

Demonstrations.

The method of presenting the instruction is a matter of chief importance. In the teaching of scientific manual training there should never be given a demonstration for a whole class. The need for class demonstration can come only from a wrong attitude towards the work on the part of both teacher and pupil. After the pupil has studied the text, done all in his power to learn it and apply it, he may fail to grasp some point. It is then the duty of the teacher to find out exactly what is lacking and by some means help the pupil out. This may often be done by questioning on the text. Sometimes additional directions may be given orally. Sometimes the teacher may answer the definite question of the pupil by the use of a tool. It is not necessary for me to argue that this answering of a definite question is essentially different from a demonstration lesson, although a part of the very same operation may be performed. In one case the pupil is looking for something to imi-

tate, in the other he is thinking and looking for an idea to complete his thought.

The class demonstration continually weakens the pupil by increasing his dependence on another. The text book and explanation method increases continually the pupil's strength by making him capable of doing without any personal assistance. In fact, as has been proven by experience, he soon learns to reason out step by step from what he knows difficult problems that are not answered even in the text. This continued through a fair school course gives the pupil power, on leaving school, to enter any of a large number of industries and with little or no assistance or "showing" reason out the needed new processes from the principles he has as his stock in trade. If he finds his stock too limited or incomplete in some detail, he has learned to go to books for help and will likely have no difficulty in finding a book that will give him the needed assistance.

The Nature of the Text.

If so much is to be gained from the study of mechanical science by the use of a text, it is evident that the character of the text is of great importance. As the chief value of the text is not to give information but to lead to generalizations and a knowledge of principles, it is essential that the text be such a carefully and systematically planned course as will have this result. For this reason the basing of the work

on reference books, or the use of methods or projects that require a large use of random references, is certain to cause a failure to get the intellectual out of the work. If the pupil is allowed to plan his work and carry it forward by use of reference works or by the assistance of the instructor he must necessarily base his course on the project, and this in turn necessitates the steps in the project determining the order of study and the getting of something done the ultimate aim. There is therefore *no power* to cause the pupil to study a single principle underlying the work he is doing. All he requires and all he will get is a process or so much of a process as he needs on his project. This bit of detail or information is not necessarily connected with anything that precedes or follows, and therefore having no logical connection with anything is soon forgotten. The result is that definite progress is not assured and the completion of such a course no evidence of ability to handle new problems. It is not certain that the pupil can repeat the very problems worked out in his school course, for each detail having been learned for immediate use and not connected by any underlying principles with other details is often forgotten as soon as used, so that at the end of the course the only things noticeable that the pupil carries away from the school is a poorly executed problem and a large over-estimate of his knowledge of mechanical work. The writer has often seen

this demonstrated by pupils who have applied to him for advanced credit after completing a part or all of the work at well known institutions. It may be found that this method of class demonstration and the attempt to complete a course in school shop work by basing the instruction on the project instead of following definitely planned courses by the use of regular texts is the chief reason why so many pupils from the manual training schools fail to make good in industry. This naturally leads to the demand for other types of schools for the teaching of industrial work. If the root of the difficulty is in the methods of instruction employed in the common schools, would it not be wise to first improve these methods before going to the large expense of establishing a separate class of schools?

Failures in Old-Line Methods.

The writer has found much evidence of the failure of the old-line methods, not only in his work with pupils in the grades and in high school, but also with those who have been prepared by well known institutions as teachers of manual training. These people, graduates of what are supposed to be our best schools, were found to be unable to perform in a proper manner many of the elementary tool operations. On taking up scientific manual training they have confessed that their former course has somehow failed to provide them with the information, but

that until actually studying the scientific principles of working materials they did not realize that their first course was so defective. The comparison made by some of these pupils, those ranking high in their credits in old-line work, would be considered gross exaggerations by those not familiar with the two systems of work.

Lack of an Established Standard.

There can be no question but that the most serious difficulty at present in the building up of a course in school shop work and the establishing of proper methods of shop instruction is the lack of proper and well understood standards with which to compare results. The work is established in a school or possibly in an entire school system and the work done is thought to be ideal. Teachers and pupils are delighted. Large and showy projects are made and pupils, teachers and parents believe that wonders have been accomplished. Eventually some of the pupils find employment in shops or factories and the school shop work is credited with the success. No careful analysis is made to determine how much these boys owe to their tool work in school nor to determine what part of the work is responsible for the results. Seldom if ever are the methods of school shop work and the methods of instruction definitely criticised, and last but not least the fact that boys have entered shops and factories in large numbers and have met with success without any school

shop work is overlooked. The determining of a standard for comparison will aid greatly in answering the question: Are the methods in use in the school shops actually producing results with the pupils that specially need this work? There is another question that has not yet been satisfactorily answered in many sections: Are the results of a permanent character, or only those contingent upon the work being new and appealing to a superficial interest by its novelty?

Spoiling Work

Another method peculiar to scientific manual training is the conducting of the class work so that seldom a piece is spoiled. Only in a very exceptional case is any pupil given a duplicate piece of material. This tends to a careful planning of work, care and system in the work, and the largest possible thought factor in every detail. It is the logical sequence of teaching principles which proceed from the known to the unknown by such steps as the pupil is able to take with certainty, and therefore there is little opportunity for spoiled projects or spoiled pieces of even small size. This avoiding of spoiled work is not to be accomplished by having the pupil lay aside his regular work from time to time and practice the various operations on extra material. With the study of principles rather than processes there is really nothing to practice, for if the principle is well understood the result is correct the first time, if it is not understood the

proper course to pursue is to get an understanding of it before attempting to apply it in the working of the material.

Although this avoids waste of material and reduces to a considerable degree the expense of carrying on the shop work, yet its chief value is in the constant increase in the power and confidence of the pupil that naturally follows the doing of tasks each more and more difficult and yet without any failures.

For pupils to demonstrate to themselves by the use of properly graded shop work that they can by proper study and effort do new and difficult tasks with a certainty that they will succeed is one of the largest possible benefits that can come from any sort of school or educational work. Is it not therefore reasonable to place a very high value on methods that will yield this return and on a system of work that readily affords an opportunity for such methods?

Our Duty Toward the Manual Training Movement

Our Duty Toward the Movement

This series of articles would be incomplete were they to close without pointing out some ways in which this movement may be aided by those interested in the welfare of our educational system and the children. It is not an easy task to point out what is needed to be done without noticing some of the deficiencies of the work as at present given in our leading schools. As we have worked and observed the work of others almost since the first manual training schools were established, we have been unwillingly forced to the conclusion that the greatest harm done to the cause is the withholding of just criticisms for fear that some one would be led to believe that the whole manual training idea is wrong. To such an extent has this feeling prevailed that even those striving diligently for the right have been forced to yield to improper methods of work because of the popularity of superficial and showy attempts by others to get results that would appeal to those having no knowledge or understanding of the larger values of manual training work.

In our criticisms and attempts to point out ways and means of aiding this movement, it must not be understood that we believe no good has yet come from the various attempts at

school shopwork. "The past has taught its lesson, the present has its duty, the future its hope," and without taking space to review what has been done, let us consider our duty at the present, not as passive recipients of the good the work is doing, but as factors in advancing this branch of school work. This subject, though well enough established to leave little doubt of its continuance as a part of the school courses, is yet new and immature when compared with the possibilities before it, and therefore has a claim on all for whatever aid is in their power to give.

Our Chief Difficulty.

Perhaps our chief difficulty lies in placing too much emphasis on what has been accomplished, for as we review the long list of benefits already received, we feel that our duty to the movement has been discharged and that now all we have to do is to continue along present lines, or, in other words, we fail to realize that we are dealing with a new and most powerful factor that is to develop into one of the most important factors in a system providing a liberal education.

Because of our experience with other subjects of the school course we make use of a false standard and fail to realize how much more can be accomplished by this new subject. We rest content, feeling that its limit has been reached when in reality the results obtained are

insignificant compared with what should be accomplished. No doubt this lack of a proper standard for comparison is the cause of much of the slackness in the administration of this part of our school work.

Should we criticise the work in any other subject of the school course, we would judge it as to whether it taught the thing intended or not and we would permit no indefinite guessing as to what was to be taught. If we were to pass judgment on the value of a composition on American history, we would not ignore the errors in historical facts and call the paper excellent because the writer had made a fine appearing paper by the aid of a writing machine, nor would we condemn a historical paper of a high order because the writing was only ordinary.

Yet we see shop work judged excellent because the pupil, or teacher, selected an artistic design, although the construction is of an extremely poor quality and lacking in all the more valuable features of manual training. We also see other work condemned because the design is not the most replete with curves and surface decoration, though it shows not only excellent workmanship, but also demonstrates large growth in both mechanical efficiency and intellectual power. To such an extent is the work based on design and superficial appearance in one of the most noted manual training schools

of this country that the advance in knowledge of working materials is all but a negligible quantity throughout the course, except with such few pupils as have a sufficiently large natural ability to dig out these principles in addition to any requirements of the school. In fact, the only pupils that appear to be advanced to any noticeable degree in the line of mechanical work, or to receive any intellectual growth from the use of tools, are those who would "dig out a trade" without a teacher if given tools and a place for work. Are we doing our duty by the pupils and the taxpayers when we establish expensive manual training schools and allow such methods of work as permit the shops and mechanical courses to be only passive elements in the school work?

Not Finding Fault.

This is not finding fault with good design or art, but as no one has yet shown any reason whatever why we cannot have these things together with the learning of the things for which manual training was established, it seems that some one has a serious duty to perform when we see schools in which various other lines of work have largely or entirely displaced the manual training work, although making use of the forms and tools properly belonging to the manual training. One does not need to visit many leading manual training schools to find, if he will take the trouble to see exactly what is

being done, pupils who have passed through the woodshops with no apparent growth in ability to work solid materials nor with any of the intellectual growth that should result from a thorough and definite study of mechanical science.

Teacher's Qualifications.

Closely allied with our duty in criticising the work is that of careful scrutiny of the teacher's qualifications. As an example, Mr. G—— secured a position in one of our largest cities as instructor in shopwork in a ward school. He was recommended by a school known to substantially all educators as a school especially qualified to fit pupils for teaching manual training. The actual preparation that this teacher received was some of the school's theories and shop practice, consisting of the making a "plant label" and partly making a "plant stick." On being asked how he managed to get along on such a limited knowledge of tool work, he replied that for the first three months he watched the pupils to see how they did the work.

The writer's observations confirm the statement of many practical men that there is altogether too large a percentage of people in the school woodshops who have nothing to teach in the line of woodwork and are therefore bluffing and trying to make a showing by pointing to the design, the art, the "self-activity of the pupil" and various other outside matters to

cover up their total deficiency in knowledge of working materials.

Another Example.

Again, in a city specially favored with an enthusiastic superintendent and plenty of means, various systems of manual training were supposed to be tried out and conclusions reached. The writer, anxious to get the best to be had, took occasion to attend as a regular pupil the classes of one of the instructors. You can imagine the writer's feelings on discovering that this teacher, supposed to be at or near the top in his line, had never thought of any principles of tool work and was grossly ignorant of many simple tool operations. In fact, he had literally nothing to teach. At best he had only a few muscular movements to go through before the class for the pupils to blindly imitate. It is no wonder that that city, after a variety of such experimenting, should now be trying a trade school. It is the duty of some one to change this condition.

Why Trade Schools?

Should we dig to the bottom of the present agitation for a dual system of schools there seems little doubt but that we will find the cause of the difficulty in the employment of incompetent instructors in the shops of the regular schools.

Scattered throughout the country are a few

teachers who actually know what they are trying to teach and actually teach it, but mixed up with these in all sorts of official relations are those who have substantially no knowledge of the fundamental principles of working solid materials and are therefore putting up all sorts of bluffs and makeshifts to take the place of actual instruction in mechanical lines. That some one has failed to do his duty is plainly evident. Our present duty is to take nothing for granted and go carefully into the details of our school shop work that no one may be misjudged. Those doing good work should be encouraged and helped to do more and better, while those bluffing at the job should be eliminated.

Duty of Superintendent.

There are many ways in which the superintendent of schools can help the manual training movement. As most of these officials have had no opportunity to study this line of work either by actually doing it or teaching it, there is exceptional need for school principals that have a thorough knowledge both of the theory and practice of shop instruction. Therefore the superintendent has an opportunity to aid much by encouraging the school principals to spend the necessary time to get a thorough knowledge of the work. Also in employing principals he can give the preference to candidates satisfactory in other respects and up in manual training

work. He will be able to aid very much by encouraging all his teachers to get as large an understanding of the shop work as their time will permit. His chief aid, however, is in helping to form a healthy public sentiment.

Basement Shops.

We may all help to get the shops out of the dark cellars and basements. It is impossible to teach the principles of shop work in a satisfactory manner unless there is an abundance of well diffused light. It is not enough that a pupil may be able to see the lines on his work by holding it up to the light. In order to learn the correct methods of doing the work, the pupil must be able to see all the lines definitely with the work in proper position on the bench. This is impossible with ordinary basement light, and especially so where it enters from but one side. While a pupil may turn a book about until the light is effective, the shop work often cannot be thus turned. Everyone having to do with the manual training work should aid in creating a sentiment that will make the use of an improperly lighted basement for shop work entirely out of the question. If room is insufficient and a basement must be used, then use it for some class that does not require so much light. Other recitations usually require half the time and therefore it is a matter of good hygiene to use the rooms for such recitations as will change the pupils about often, keeping

one class in the unpleasant surroundings for as short a time as possible. With properly conducted courses, the noise and litter of the woodshop need not hinder its being located in any schoolroom. We are rapidly passing from that stage in the development of shop work when its success is to be measured by the amount of noise made and the piles of shavings and materials, possibly spoiled pieces littered about the room. We have almost reached a point when we can say that the actual value of the work is inversely as the amount of noise and also the quantity of materials used. It is therefore true that the school shop has no greater claim on us all than to have this fact recognized and be placed in a respectable part of the school buildings.

Is the Pupil Thinking?

Another duty that can be successfully performed only by those familiar with the educational processes and able to judge accurately of the intellectual activities of the pupils, as well as having an exact knowledge of the shop problems, is the careful analysis of the work to determine whether it is resulting in actual thinking or only in simple perceptions. Is the pupil merely receiving, bit by bit, such fragments of information as he requires in the making of his project or is he forming generalizations and learning fundamental principles that he understands and will be able to apply to other and

various problems? No more important task is before those able to carry on this line of criticism and no other line of criticism will do so much to establish the valuable and eliminate the worthless.

To place correct values on each detail of the work, though a matter of no small labor, is also a matter of no small importance. It is neither just to the shop work nor to the pupils to permit extraneous matter to be traded for the real values of tool work, nor can we hope to make definite progress so long as this substituting is permitted. Only by this careful analysis of the work and the placing of the true value on each part can we hope to strengthen the weak places and crowd out or to less important places that which is not primarily manual training. Today we are religiously holding to certain methods of work because in the past they have been compared with other even more defective and found better. Such a method of elimination can lead only to confusion. We should rather, however great the task, see that we are comparing correct values, or at least not settle down to a fixed conviction until such a comparison can be made. Should we undertake such a review of our conclusion we may find that all the confusion that has been so characteristic of the manual training movement has been caused by this drawing of conclusions from imperfect data, or, in brief, by judging of

the school work and its possibilities by the work of those who have absolutely no knowledge of modern mechanical science as exemplified in the high type of workmanship found in our leading American industries, but who, because of other training, are able to accomplish things worthy of our notice however inferior to that which is possible by using the subject matter properly forming the content of the manual training courses.

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